Opisthobranch Mollusks from the Southern Tropical Pacific[1]

ERNST MARCUS and EVELINE MARCUS[2]

ABSTRACT: Twenty-four species of opisthobranchs are listed from the southern tropical Pacific Ocean, from Fiji and the Ellice Islands eastward to the Tuamotus. Two new genera are described: *Pleurehdera* (Pleurobranchidae; type species: *P. haraldi* n. sp., Tuamotus) and *Pupsikus* (Doridiidae; type species: *P. pinguis* n. sp., Tahiti). The following five other new species and subspecies are described and figured: *Noumea norba* (Doridiidae: Chromodoridinae, Viti Levu, Fiji); *Peronodoris rehderi* (Doridiidae: Archidoridinae, Tahiti); *Tayuva ketos juva* (Doridiidae: Discodoridinae, Rurutu, Tubuai Islands); *Phyllidia tula* (Phyllidiidae, Nukulaelae, Ellice Islands); *Phyllidia soria* (Tahiti). The internal anatomy of these species, as well as of many of the previously known species, is described. Many species are recorded from Polynesia for the first time.

THE OPISTHOBRANCH MOLLUSKS discussed in this paper were sent to us for classification by Dr. Harald A. Rehder, Smithsonian Institution, Washington, D. C. They were gathered by Dr. Rehder and his collectors in the tropical southern Pacific in an area centering in the Society Islands and the neighboring Tubuai Islands. Some species are from the Tuamotus to the east and others from Tonga, Fiji, and the Ellice Islands to the west. The collection comprised 24 species, of which 7 are new and 2 represent new genera.

Certainly a collection made by a resident like Risbec in New Caledonia, with drawings of the living animals and observations of their spawn and mode of life, is of greater value than morphological studies on preserved specimens collected without drawings and accompanied by inadequate descriptions of their habitat. However, the small number of specialized workers results in the accumulation of discolored material in the museums that would remain useless for science if they were not studied the hard way.

We are grateful to Dr. Rehder for allowing us to examine this collection, and to him and Dr. Joseph Rosewater, also of the Division of Mollusks, Museum of Natural History, Smithsonian Institution, for arranging the sending and return of this collection through the kind offices of the U. S. General Consulate in Sao Paulo.

LIST OF OPISTHOBRANCHS DISCUSSED

Order Anaspidea

Family Aplysiidae (subfamily Dolabellinae)

1. *Dolabella auricularia* (Lightfoot)

Subfamily Dolabriferinae

2. *Dolabrifera dolabrifera* (Rang)

Subfamily Notarchinae

3. *Stylocheilus longicauda* (Quoy and Gaimard)

Order Notaspidea

Superfamily Pleurobranchacea

Family Pleurobranchidae (subfamily Pleurobranchinae)

4. *Oscanius grandis* (Pease), figs. 1–7
5. *Pleurehdera haraldi,* new genus, new species, figs. 8–12

Order Dorioidea

Suborder Eudoridacea

Tribe Hexabranchia (family Hexabranchidae)

6. *Hexabranchus marginatus* (Quoy and Gaimard)

1 Manuscript received June 2, 1969.

2 P. O. Box 6994, Sao Paulo, Brazil. Dr. Ernst Marcus died on June 30, 1968.

Tribe Cryptobranchia (family Doridiidae)
Subfamily Chromodoridinae
7. *Chromodoris quadricolor* (Rüppell and F. S. Leuckart)
8. *Hypselodoris* cf. *godeffroyana* (Bergh), figs. 13–18
9. *Noumea norba,* new species, figs. 19–22
Subfamily Miamirinae
10. *Casella atromarginata* (Cuvier)
11. *Orodoris miamirana* Bergh, figs. 23–26
Subfamily Archidoridinae
12. *Peronodoris rehderi,* new species, figs. 27–30
Subfamily Discodoridinae
13. *Sebadoris crosslandi* (Eliot)
14. *Tayuva ketos juva,* new subspecies, figs. 31, 32
Subfamily Platydoridinae (Arginae)
15. *Platydoris scabra* (Cuvier)
16. *Pupsikus pinguis,* new genus, new species, figs. 33–39
Tribe Phanerobranchia
Superfamily Nonsuctoria (family Gymnodorididae)
17. *Gymnodoris citrina* (Bergh), fig. 40
18. *Gymnodoris striata* (Eliot), fig. 41
Suborder Porostomata
Family Dendrodorididae
19. *Dendrodoris nigra* (Stimpson)
20. *Dendrodoris denisoni* (Angas), fig. 42
Family Phyllidiidae
21. *Phyllidia* (*Phyllidia*) *tula,* new species, figs. 43–47
22. *Phyllidia* (*Phyllidiella*) *annulata* Gray, figs. 48–49
23. *Phyllidia* (*Phyllidiella*) *variabilis* (Collingwood), figs. 50–52
24. *Phyllidia* (*Phyllidiella*) *soria,* new species, figs. 53, 54

Dolabella auricularia (Lightfoot, 1786)

Dolabella scapula (Montagu) Engel, 1942, pp. 207–234, figs. 6–16; Marcus and Marcus, 1960, pp. 894–896, figs. 32–35.

RANGE: Indo-Pacific from the Red Sea and East Africa to Japan and Easter Island; also Ecuador, the west coast of Mexico, and the Gulf of California.

COLLECTING STATIONS: Society Islands: Papara, 40 km south of Papeete, Tahiti, in black sand and under coral, depth 1–2 m, 1963, R. L. Sixberry, 3 specimens (USNM 576013, 576014, 576015); Arue, Tahiti, under dead coral rubble, depth 1.2 m, 1963, R. L. Sixberry, 1 specimen (USNM 575999).

DESCRIPTIVE NOTES: The shell and the male copulatory organ characterize the species. The largest specimen (576014) is 140 mm long, 70 mm broad, and 58 mm high; its shell measures 45 by 24 mm. The animals are nearly smooth, with scarce warts.

Dolabrifera dolabrifera (Rang, 1828)

RANGE: Circumtropical and circumsubtropical, but not yet recorded from the American Pacific coast.

COLLECTING STATIONS: Society Islands: W of Point Tiva, Huahine, white sand and algae, depth 1.3 m, February 18, 1965, R. L. Sixberry, 4 specimens (USNM 576153); Mitirapa, Tahiti, September 2, 1964, R. L. Sixberry, 1 specimen (USNM 576009).

DESCRIPTIVE NOTE: Due to the subequal prongs of the radular teeth, Pruvot-Fol (1954, p. 13, fig. 15 on p. 12) considers her specimens from Tahiti as possibly distinct from *D. dolabrifera.* The present material also has such radular teeth, but, as previously mentioned (Marcus and Burch, 1965, p. 244), they do not characterize a geographic form but occur also in material from the Indian Ocean (Eales, 1944, fig. 9A).

Stylocheilus longicauda (Quoy and Gaimard, 1824)

RANGE: Circumtropical and circumsubtropical; also from the Gulf of California (Marcus and Marcus, 1967, p. 159).

COLLECTING STATION: Society Islands: Papenoo, Tahiti, reef flat, R. L. Sixberry, 3 specimens (USNM 576000).

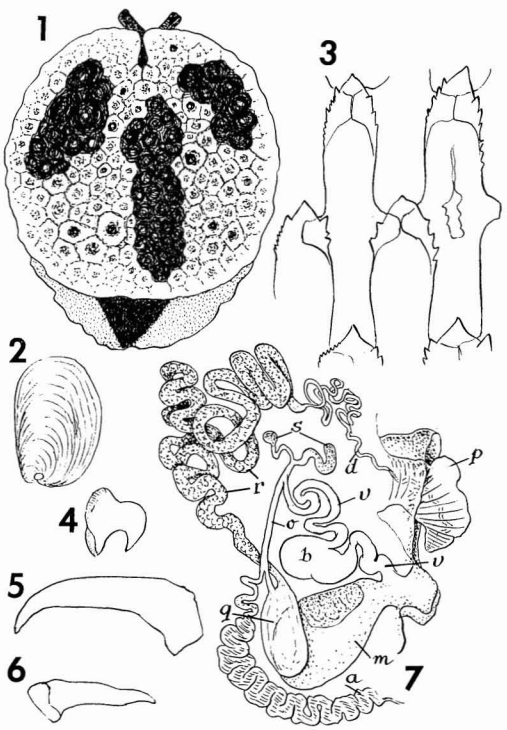
DESCRIPTIVE NOTE: The animals have the longitudinal black streaks and ocellar spots typical of the species.

Oscanius grandis (Pease, 1868)
Figs. 1–7

Pleurobranchus grandis Pease, 1868, pp. 78–79, pl. 10, fig. 2.
Oscanius grandis Pilsbry, 1896, pp. 218, 219, pl. 45, fig. 1.
Pleurobranchus (*Susania*) *grandis* Vayssière, 1898, pp. 375–377, pl. 15, fig. 24.

RANGE: Society Islands.

COLLECTING STATIONS: Society Islands: Papara, 40 km south of Papeete, Tahiti, in black sand and under coral, 1963, R. L. Sixberry, 2 specimens (USNM 576013); northeast tip of Motu Iriru, Raiatea, level sandy area, collected at night, March 8, 1965, R. L. Sixberry, 1 specimen (USNM 675467).



FIGS. 1–7. *Oscanius grandis*. *1,* Preserved animal from Raiatea. *2,* Shell. *3,* Jaw platelets. *4,* Innermost radular tooth. *5,* Radular tooth from middle of half-row. *6,* Outermost radular tooth. *7,* Diagram of reproductive organs.
(*a*) Ampulla, (*b*) bursa, (*d*) male duct, (*m*) female gland mass, (*o*) inner oviduct, (*p*) penis, (*q*) prostate, (*r*) prostatic duct, (*s*) spermatocyst, (*v*) vagina.

DESCRIPTION: The preserved animals from Tahiti are 75 and 65 mm long, 50 and 58 mm broad, and 10 and 11 mm high; the specimen from Raiatea is larger, 80 mm long, 60 mm broad, and 20 mm high. Its foot is 70 mm long, 50 mm broad; the notum, 65 by 60 mm. The shell (Fig. 2) lies in front of the middle, and it is 8.4 mm long, 6.0 mm wide in the longer animal from Tahiti, pink and with growth lines. The periostracum which fell off from the drying shell showed spiral lines, mainly in the apical part.

The especially well preserved specimen from Raiatea (Fig. 1) is light brown with darker centers in the dorsal polygons, and with sharply delimited dark brown spots. Two big spots lie to the sides in front, a larger one farther back in the middle, and one on the tail passes as a triangular fleck onto the foot. Smaller notal spots are seen in Figure 1. The rhinophores, the lappets around the genital apertures, the gill, and the inner part of the hyponotum are dark brown. The pigment of the hyponotum continues onto the back of the foot. The broad and folded penis is light, the sole yellowish grey without flecks.

The notum bears polygons up to 9 mm in diameter, separated from each other by ridges. They are flat except for a central, generally darker knob. The knobs are surrounded by an inner ring of ridges connected to the outer ridge by radial ones. Small knobs lie in the area between the two rings. Where the notum is somewhat contracted, irregular concentric bulges appear around the central knobs, and the limits of the polygons are marked as furrows. Spicules or vestiges of spicules were not found.

The anterior pedal border is bilabiate; the pink upper lip is slightly shorter and thicker than the lower lip. The posterior pedal gland lies in the dark area and is not very distinct. The frontal veil is small, furrowed laterally, and blackish brown at its base. The rolled rhinophores lie near one another. The gill is about half the length of the body. Of its 20 to 22 plumules on either side of the rhachis, 7 to 10 are free from the branchial membrane. The main rhachis and the secondary rhachises bear tubercles. The anus is located over the end of the branchial membrane, Bourne's gland between the genital lappets and the beginning of

the gill. The female aperture opens between two reddish lips.

The buccal armature was examined in the larger animal from Tahiti. The jaws are yellow, their slender elements (Fig. 3) thrice as long as broad when measured with the lateral processes, five times as long without these. In some places the platelets are broader, twice as long as broad with processes, thrice without. Also the denticles vary; the largest median point is often flanked by rather prominent denticles, and these are followed by 0 to 10 smaller ones. The radula is 9 mm long, 10.5 mm broad, and comprises about 100 rows with 240 teeth per half-row. The teeth (Figs. 5, 6) are smooth, rather slender, 50μ high near the rhachis (Fig. 4), 140μ in the middle of the half-row (Fig. 5), and shorter again outward (Fig. 6). In the intestine, didemnids and a snail, probably a columbellid, were found.

The reproductive organs (Fig. 7) correspond to the *Oscanius*-type (Vayssière, 1898, pl. 27, fig. 184) diagrammed by Pruvot-Fol (1960, fig. 21B). The inner oviduct (*o*) enters the vagina (*v*) which goes out from the ectal part of the outer oviduct. The latter is differentiated into a hard brown albumen gland and a soft white mucus gland (*m*).

Particularities of the present species are: (1) the two different parts of the male gland (prostate), an inner, white, massive part (*q*) and an ectal grey duct with glandular walls (*r*); and (2) the two receptacula (bilobed spermatocyst, *s*) at the junction of inner oviduct and vagina. A farther ectal widening of the vagina is strongly muscular but evidently corresponds to a bursa (spermatheca, *b*).

REMARKS: Pease's original figure (1868, pl. 10, fig. 2), reproduced by Pilsbry (1896, pl. 45, fig. 1) and Vayssière (1898, pl. 15, fig. 24), made it possible to recognize the species which was described originally from Huahine, Society Islands. The living animals are 15–16 cm long. In the original material a shell was absent; nevertheless, Vayssière (1898, p. 376) supposed that a small shell occurs.

O. grandis appears in Bergh's list (1897, p. 65), but is mentioned only once in the later literature (Guang-Yu and Si, 1965*b*, pp. 267, 274). These authors compared their *O. sishaensis* from Hainan with *O. grandis*. The sculpture of the two species is similar, but the color of back and foot gland and the lanceolate jaw elements in *O. sishaensis* disagree. Also the sculpture of *O. sculptatus* (O'Donoghue, 1929*b*, pp. 40–41) from Mozambique conforms with that of *O. grandis*, but the color and the conchinous parts are different. The Malaysian *O. lugubris* (Bergh, 1905*a*, p. 60) is somewhat similar to *O. grandis* but certainly not conspecific. *O. blainvillei* (Pilsbry, 1896, p. 219), also from Tahiti, is quite different from *O. grandis*.

Pleurehdera, new genus

Middle-sized pleurobranchids with anteromedian rhinophores overlain by the free anterior mantle border which is entire, not emarginate. Shell situated forward. Large pedal gland and smooth branchial rhachis. Anus in front of hind end of gill membrane. Genital apertures without surrounding lappets. Jaw elements denticulate; radular teeth with a denticle on the concave side.

TYPE SPECIES: *Pleurehdera haraldi*, new species

We continue to use Odhner's (1926) arrangement of the Pleurobranchidae, codified by Thiele (1931), and distinguish two subfamilies, the Pleurobranchinae and the Pleurobranchaeinae. In the latter subfamily Thiele correctly mentioned *Pleurobranchella* Thiele (1925, p. 283) but not *Pleurobranchoides* O'Donoghue (1929*b*, p. 62; Eales, 1938, pp. 90–92), the description of which he did not see (Thiele, 1935, p. 1035). On the other hand, O'Donoghue evidently overlooked *Pleurobranchella*, which can hardly be distinguished from *Pleurobranchoides*. It belongs also to the Pleurobranchaeinae, not to the Pleurobranchinae as indicated by Zilch (1959, p. 62). *Gigantonotum* Guang-Yu and Si (1965*b*, pp. 270, 275) resembles Thiele's and O'Donoghue's genera.

Pleurehdera haraldi belongs to the Pleurobranchinae because of its anteromedian rhinophores and the free mantle border. Burn raised this group and the Pleurobranchaeinae to family rank (1962, p. 130). However, his subdivision of the Pleurobranchidae into Berthellinae and Pleurobranchinae is not supported by *Pleu-*

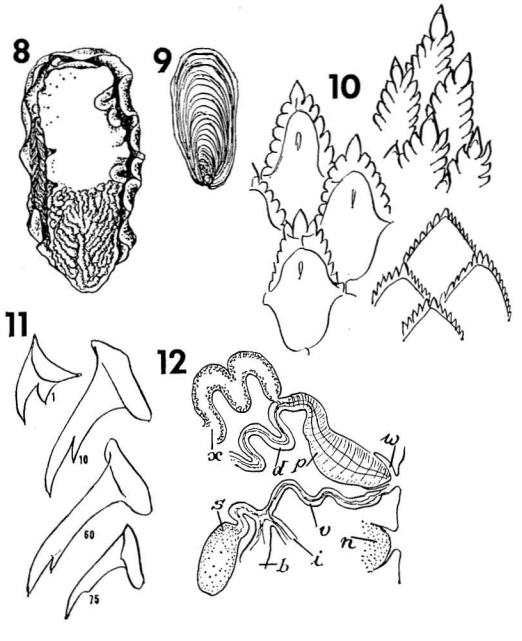
rehdera haraldi, which has berthellinan smooth gill rhachis and pleurobranchinan pedal gland. The place of the new genus is between *Berthella,* resembling that genus in possessing an entire mantle border and a naked branchial rhachis, and in its reproductive organs, and resembling *Pleurobranchus* by its foot gland. The variable shape of the jaw elements of *P. haraldi* diminishes the contrast between the Pleurobranchinae (sensu Burn, 1962), with ensiform platelets, and the Pleurobranchaeinae, with quadrilateral to polygonal ones.

The genus and species is named for Dr. Harald A. Rehder.

Pleurehdera haraldi, new species

Figs. 8–12

COLLECTING STATION: Tuamotu Archipelago: Amanu Atoll, Sta. P 10-64, shallow reef, lagoon side of pass between Hikitake Island and island to the south, 3–10 m, September 22, 1964, R. L. Sixberry, 1 specimen (USNM 576018).



FIGS. 8–12. *Pleurehdera haraldi,* n. g., n. sp. *8,* Ventral view of preserved animal. *9,* Shell. *10,* Labial elements from different regions. *11,* Radular teeth. *12,* Outer part of reproductive organs.

(*b*) Spermatheca, (*d*) male duct, (*i*) insemination duct, (*n*) nidamental duct, (*p*) penis, (*s*) spermatocyst, (*v*) vagina, (*w*) atrium, (*x*) accessory prostate.

DESCRIPTION: The preserved animal is 30 mm long, 16 mm broad, and 8 mm high. The foot, which was folded upward at its hind end, is 30 mm long and 11 mm broad. The caudal third is thickened as a pedal gland which occupies nearly the whole width (Fig. 8). The brown, rather flat shell (Fig. 9) lies in the anterior part of the notum. It is 10.2 mm long, 5 mm broad, has salient growth lines and fine spiral marks in the apical part. The protoconch is hidden under the apex. The conchinous border of the shell is narrow.

The opaque notum is longish oval, rather flat, and wrinkled. Its border is entire in front and behind, thick and undulate; it is black with a narrow white margin; in many places the pigmented epithelium is rubbed off. The notum extends considerably beyond the body and all sides; only the tail may protrude. The subcutaneous conjunctive tissue of the notum contains vestiges of radiate spicules. The light foot is bilabiate in front and pointed behind, where it projects from under the notum when unfolded, as in Figure 8. The dorsal side of the foot is black; the veil, the rhinophores, and the hyponotum also have traces of black pigment.

The veil does not project between notum and foot. The sides of the veil are grooved; over its middle appear the tips of the rolled rhinophores, which arise from a common base. The gill contains about 20 alternating pinnules on either side, 10 of which are in the free part behind the branchial membrane. The rhachis is naked. The anus lies over the membrane in front of its hind end. The genital apertures are not surrounded by lappets.

The pharynx is remarkably small, 3 mm long. The jaws are light, and the shape of their platelets varies widely (Fig. 10) according to the area of the mandible, as in other pleurobranchids (Pruvot-Fol, 1934, p. 32). The radula is 3 mm long, 2.3 mm broad, has about 95 rows and 85 teeth per half-row. The saber-shaped teeth are 30μ long beside the rhachis and 60μ in the middle of the half-row. The concave side of each tooth bears a denticle which decreases gradually outward, where about 20 teeth may be smooth.

The ampulla is full of sperm. The very hard female gland mass consists of a brownish albumen gland and a blackish mucus gland. A

massive muscular penis (Fig. 12*p*), similar to that of *Berthella agassizii* (Marcus and Marcus, 1957, fig. 39), projects into a small atrium (*w*). An accessory prostate (*x*) is annexed to the male duct (*d*) at the root of the penis. Near the tip of the penis the vagina (*v*) arises from the atrium and leads to the sperm reservoirs, a large bursa full of debris (*b*) and a smaller spermatocyst (*s*).

Hexabranchus marginatus (Quoy and Gaimard, 1832)

Hexabranchus lacer (? non Cuvier, 1804) Bergh, 1900, p. 226 (general anatomy).
Hexabranchus marginatus Bergh, 1905*a*, pp. 90 ff.
Hexabranchus sanguineus (Rüppell and F. S. Leuckart, 1828) Eales, 1938, p. 92 (nervous and reproductive systems).

RANGE: Red Sea (Eliot, 1908, p. 98); Indian Ocean: western (Eliot, 1910, p. 419) and eastern parts (Bergh, 1905); Formosa, Ryukyu Islands, southern and middle Japan (Baba, 1936, p. 23; 1938, p. 1); Caroline and Marshall islands (Marcus, 1965, pp. 271, 272); Laysan (Bergh, 1900); eastern Australia; Lord Howe Island; New Caledonia; Tonga Islands (Iredale and McMichael, 1962, p. 94; Allan, 1950, p. 223; Risbec, 1928, p. 116). The taxonomic state of the old and new materials from the Hawaiian Islands is difficult to evaluate (Ostergaard, 1955, pp. 128 ff).

COLLECTING STATION: Tubuai Islands: Tubuai, June 1965, R. L. Sixberry, 1 specimen (USNM 576437).

REMARKS: We apply the name most frequently found in the literature, though the above used by Eales (1938) is probably prior. The differences between the species of *Hexabranchus* are quite obscure (Marcus and Marcus, 1962, p. 471), and therefore we document the records in our survey of the range by authoritative references.

The present specimen whose red color had faded out completely is middle-sized, 80 mm long, 70 mm broad. Living animals of this biggest doridacean are up to 250 mm long and 150 mm wide (Risbec, 1953, p. 58). The radula of our specimen has about 40 rows and 65 teeth per half-row; similar numbers were given by Bergh (1905*a*) and Baba (1936). The reproductive organs agree well with Eales' figure (1938, fig. 12). Only the spermatocyst of the specimen at hand is considerably larger than in Eales' animal, but this is a functional difference. Our Figure 17 of *Hexabranchus morsomus* (Marcus, 1962) shows a shorter male copulatory organ than in the present one and in Eales' specimens of *H. marginatus*, but the Atlantic species is based upon a slug half the size of the latter.

Chromodoris quadricolor (Rüppell and F. S. Leuckart, 1828)

Glossodoris quadricolor Engel and Nijssen-Meyer, 1964, pp. 27–32, figs. 1–5, color plate, figs. 1–3.

RANGE: Indo-West Pacific, from East Africa and Red Sea to middle Japan and New Caledonia.

COLLECTING STATION: Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 2 specimens (USNM 576432).

Hypselodoris cf. *godeffroyana* (Bergh, 1877) Figs. 13–18

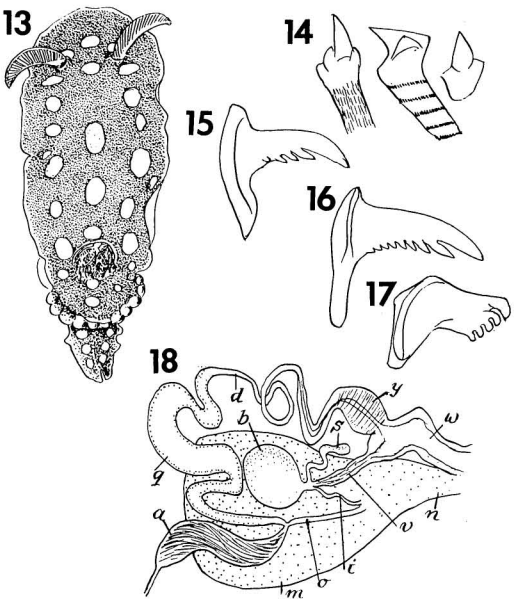
Chromodoris godeffroyana Bergh, 1877, p. 493; 1879, p. 12.

RANGE: Society Islands: Huahine.

COLLECTING STATION: Society Islands: Mitirapa, Tahiti, September 2, 1964, R. L. Sixberry, 1 specimen (USNM 576049).

DESCRIPTION: The preserved animal is about 30 mm long, 11 mm broad, and 10 mm high. The free mantle border which is not very wide contains a postbranchial semicircle of glands. The tail is long. The color, in preserved condition, is café au lait on the notum; the border is light. About 3 rows of light convex spots, oval and of different size, occur on the mantle; also the lighter brown hyponotum and the back of the foot have light spots. The sole is light brown without spots.

The borders of the rhinophoral pits and the branchial pocket are raised. The brown rhinophores have a white rhachis and 26 foliations. Also the rhachis of the 24 unipinnate light brown gills is white. The anterior ones are



FIGS. 13–18. *Hypselodoris* cf. *godeffroyana*. *13,* Dorsal view of preserved slug. *14,* Labial elements. *15,* Radular tooth near rhachis. *16,* Radular tooth near middle of half-row. *17,* Outermost radular tooth. *18,* Diagram of reproductive organs.

(*a*) Ampulla, (*b*) spermatheca, (*d*) male duct, (*i*) insemination duct, (*m*) female gland mass, (*n*) nidamental duct, (*o*) inner oviduct, (*q*) prostate, (*s*) receptaculum, (*v*) vagina, (*w*) atrium, (*y*) sphincter.

larger than the hind ones, whose base forms a spiral on either side. The 4 dorsomedian plumes are evidently in regeneration as in Bergh's original material; from their shafts arise 2 to 5 new branches. The tentacles are grooved and folded transversely, probably due to contraction. The anterior border of the foot, the lateral angles of which are rounded, not salient, is bilabiate but not notched.

The oral cavity is about 6 mm long, the pharynx 4 mm. The labial cuticle forms four areas, two big ones on the sides, one dorsal, and a ventral smaller one. The elements consist of transversely stratified rods which end with a pointed plate flanked by two smaller tips. The radula comprises 100 rows with 90 teeth per half-row. The rhachis is damaged, and so the innermost teeth cannot be recognized. The next teeth have a strong cusp and 7 to 8 outer denticles. The first of these is larger than the following ones so that the *Hypselodoris* character of the radula is evident. The outermost teeth have a blunt cusp and 3 to 4 denticles under it.

The reproductive organs (Fig. 18) correspond to those of the other Chromodoridinae. Remarkable are the strong sphincter (*y*) of the ejaculatory duct and the folded vagina (*v*). The seminal reservoirs are empty; probably the larger one is the bursa (*b*) and the tubular one the receptaculum (*s*) which becomes spherical when the sperm pass into it from the bursa. The insemination duct (*i*) enters the gland mass (*m*) quite near the entrance of the inner oviduct.

REMARKS: Morphologically the specimen at hand must be compared with *H. cuis* Marcus (1965, p. 272) from the Caroline Islands and with two species from the Society Islands, *H. ransoni* (Pruvot-Fol, 1954, p. 18) and *H. godeffroyana* (Bergh). *H. cuis* is 6.5 mm long preserved, has 10 rows of dots on the notum, and 9 gills. Its labial hooklets stand in two triangular areas. The radula has 52 rows with 35 teeth per half-row, which bear 3 to 5 denticles. The size and the number of gills of *H. ransoni* were not indicated. The dorsal marks are spots encircled by one or two rings. The radula comprises 50 rows; each half-row has 43 teeth which bear up to 5 denticles. *H. godeffroyana* agrees with the present material in body size, number of gills, labial armature, and radula. However, we cannot apply its name without reservation because in *H. godeffroyana* the notum has many more and much smaller dots, and projections of the dark margin enter the notum. Also in preserved material of *H. godeffroyana* this pattern was distinct.

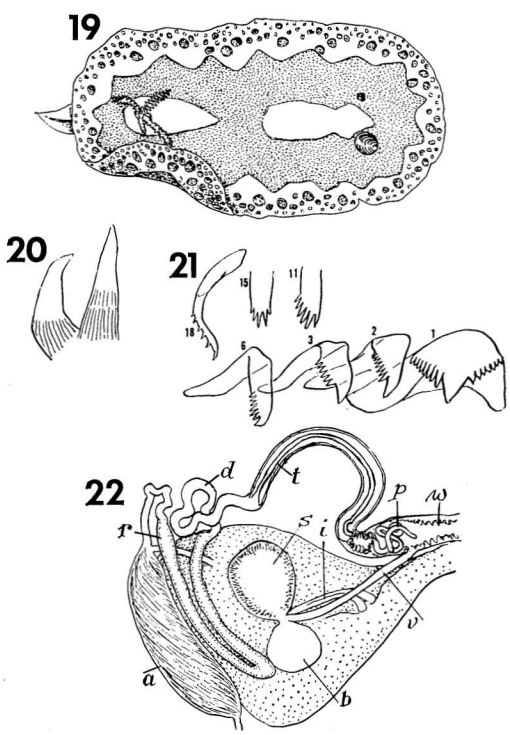
In her discussion of *H. godeffroyana* Pruvot-Fol (1951, pp. 107, 141) mentions the similar pattern of *Chromodoris histrio* Bergh (1877, p. 493; 1879, p. 8; 1902, p. 26)—but that is a *Chromodoris*.

Noumea norba, new species

Figs. 19–22

COLLECTING STATION: Fiji Islands: Thakau Moi, off north coast of Viti Levu, December 10, 1965, R. Jameson, 1 specimen (USNM 576429).

DESCRIPTION: The broadly elliptical body is evenly rounded in front and behind. The notum



FIGS. 19–22. *Noumea norba,* n. sp. *19,* Dorsal view of preserved slug. *20,* Labial elements. *21,* Radular teeth. *22,* Diagram of reproductive organs. (*a*) Ampulla, (*b*) spermatheca, (*d*) male duct, (*i*) insemination duct, (*p*) penis, (*r*) prostatic duct, (*s*) spermatocyst, (*t*) sheathed male duct, (*v*) vagina, (*w*) vestibule.

covers the head and the tail except the tip of the latter. The length is 13 mm, the breadth 8 mm, the height 5 mm. The free border of the mantle is 2 mm wide in front and on the sides, 3 mm behind. The animal is colorless, rather transparent. Two longish, opaque white patches, separated from one another, occur on the notum. One begins in front of the rhinophores, the other ends behind the branchial pocket. The notum is dotted with small unicellular glands which stain with carmine. The opaque white, broad border of the mantle enters the central area of the back with wavy projections; on the ventral side it is smooth. It is interrupted by many transparent unicellular glands bigger toward the inner limit of the margin, smaller and more numerous outward.

Vestigial spicules were seen in the notum. The intact right rhinophore has 15 foliations. The border of the branchial pocket is raised and bears small papillae containing glands of the type occurring in the central part of the notum. Only 4 unipinnate gills project from the branchial cavity, the others seem to be lost. The tentacles are small folds; the anterior border of the foot is bilabiate, not notched. The end of the tail is pointed.

The labial cuticle forms a complete ring. Its longitudinally striped elements are 23μ long, 7–8μ broad at the base, simple, spinelike, and exceptionally bifid at the tip. The radula has 36 rows with a total of 18 teeth on either side of the naked rhachis. The innermost 40μ-high tooth has a 65μ-broad base, 6 denticles on the inner side of the cusp, and 7 to 8 on its outer side. The second tooth is much narrower and has 6 to 8 outer denticles. The number of denticles decreases gradually outward, but even the outermost tooth has 2 to 5 denticles. The length of the principal cusp also diminishes outward; it becomes shorter than the denticles.

The rather short ampulla (Fig. 22*a*) is full of sperm. The inner, wide part of the sperm duct is glandular (*r*), the next coiled, muscular part (*d*) is narrower. The outer, sheathed part (*t*) seems to end in a long thin unarmed penial papilla (*p*) projecting into the atrium (*w*). There is no vestibular gland.

A long thin vagina (*v*) arises from the atrium and leads to a small empty bursa (*b*) and a bigger receptaculum (*s*) containing parallel rows of sperm. The insemination duct (*i*) leaves the vagina at its entrance into the seminal receptacles and opens with a thickening into the female gland mass (*m*) rather far ectally.

Norba is a name in Lusitanian history.

REMARKS: On the coast of New Caledonia, Risbec (1928; 1930) found four different chromodoridids with an especially broad innermost lateral tooth, and separated them as *Noumea* from *Chromodoris.* Pruvot-Fol (1951, pp. 126, 139) questioned the validity of this genus because a larger innermost lateral tooth occurs also in several species of *Chromodoris* and *Hypselodoris.* However, she is inclined to admit the unusual breadth of this obliquely shaped tooth in *Noumea romeri,* the first of Risbec's species (1928, p. 165), the type species

(Baba, 1937*a*, p. 298). We maintain *Noumea* because the very numerous species of the Chromodoridinae need as many subdivisions as possible. Their radulae furnish the best generic characters. The jaw elements, rods, hooks, or platelets, are useful for the separation of the species. The color pattern of the living slugs is very important, but several times the colors of species with quite different radulae agree (Pruvot-Fol, 1951, nos. 54, 95, 202). In many cases the intraspecific variability of the colors is still being debated. It is safer to recognize a species, the radula of which is well analyzed while the colors have faded, than the many old species without notes on the radula but with a detailed description of the colors, often of only a single specimen. The separation of genera as *Risbecia* Odhner (1934, p. 249) and *Felimare* Marcus (1967, p. 62) is based upon the height of the rhachidian tooth. In the same way the breadth of the innermost lateral tooth, twice that of the next, characterizes *Noumea* and excludes a species such as *Chromodoris nyalya* Marcus (1967, p. 53) with an innermost tooth broader than the next only by one third. In the following list of the species of *Noumea* we indicate for each species one or more features which differ from those of *N. norba:*

(1) *N. cameroni* Burn (1966*a*, p. 193). Innermost tooth with 2 inner and 1 outer denticle. Furthermore, Burn's marginal teeth have 1 denticle on the outer side.

(2) *N. decussata* Risbec (1928, p. 168; 1953, p. 86). Innermost tooth with 1 inner and 2 outer denticles. Labial elements distinctly bicuspid.

(3) *N. flava* Risbec (1928, p. 168; 1953, p. 89). Innermost tooth with 7 inner and 1 outer denticle. Labial elements with 3 or 4 cusps. The color of Risbec's specimens agrees with that of *Chromodoris flava* Eliot (1904, p. 399) whose radula is not known and the single specimen of which is lost. Therefore, Eliot's name cannot be used as author of *N. flava.*

(4) *N. margaretae* Burn (1966*a*, p. 195). Innermost lateral tooth with only a single denticle on the outer side. Also the two following teeth with 1 outer denticle; the further teeth with simple cusps.

(5) *N. nivalis* Baba (1937*a*, p. 298; 1949, pp. 54, 144; 1953, p. 205). Innermost lateral tooth with 1 inner and 2 to 3 outer denticles. In Abe's book (1964, p. 49) this species is synonymized with *N. decussata,* as Pruvot-Fol (1951, p. 126) had suggested.

(6) *N. parva Baba* (1949, pp. 54, 144; 1953, p. 205). Innermost lateral tooth higher than broad and with 2 outer denticles. Baba was right to place *N. parva* close to *N. violacea.*

(7) *N. purpurea* Baba (1949, pp. 55, 144; 1953, p. 205). Innermost lateral tooth much higher than broad. The figure of the radula (1949, fig. 63) does not allow for a comparison of the width of the innermost and the following tooth. In Abe's book (1964, p. 50) the species is called *Noumea gloriosa* (Bergh), a synonym (Pruvot-Fol, 1951, p. 107) of *Chromodoris varians* Pease.

(8) *N. romeri* Risbec (1928, p. 165; 1953, p. 85). Innermost lateral tooth with 2 outer and 2 inner denticles. The second tooth with 3 outer denticles, the 11 following teeth without denticles. Labial elements bi- or tricuspid.

(9) *N. tasmaniensis* (? non Bergh, 1905*b*, p. 69; Burn, 1957, p. 17; 1961, p. 56; 1966*b*, p. 332). Innermost lateral tooth higher than broad, with 2 inner and 3 outer denticles. Neither Bergh's text nor his figures (pl. 5, figs. 14, 15) suggest that Bergh's species can be allotted to *Noumea.* The similar color pattern of Burn's material is not sufficient to consider it as conspecific with Bergh's.

(10) *N. violacea* Risbec (1930, p. 281). Innermost lateral tooth with 2 median cusps, one over the other.

Possibly *Chromodoris inconspicua* Eliot (1904, p. 398), with a very broad innermost tooth which bears 8 inner and 7 outer denticles, belongs to *Noumea.* The labial hooklets are in part bifid and the rhinophores are black, so that it is not identical with the present species. The single specimen of *C. inconspicua* was not figured. If it belongs to *Noumea,* it would be the only species from the western part of the Indian Ocean.

N. norba cannot be separated from the many chromodoridids, the radulae of which are not known.

? *Casella atromarginata* (Cuvier, 1804)

RANGE: Indo-Pacific, from the Red Sea eastward to Tahiti.

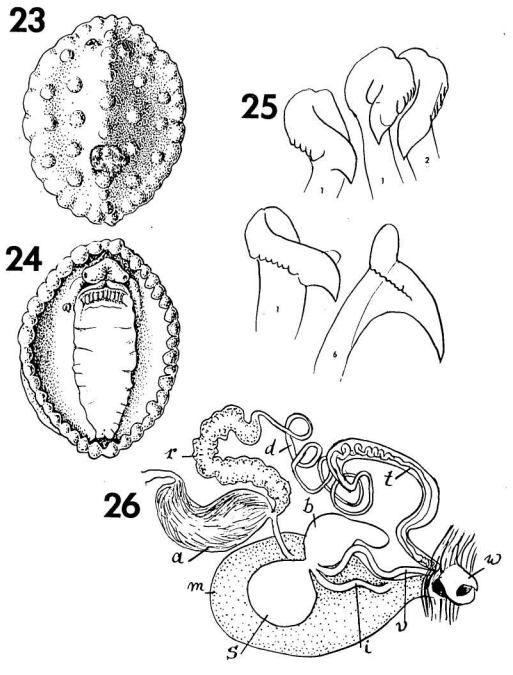
COLLECTING STATION: Society Islands: Mitirapa, Tahiti, September 2, 1964, R. L. Sixberry, 1 specimen (USNM 576011).

NOTE: Because the animal had ejected its buccal mass, the determination could not be confirmed by the radula, but the other characters (Marcus and Marcus, 1960, p. 904) agree.

Orodoris miamirana Bergh, 1875
Figs. 23–26

Orodoris miamirana Bergh, 1875, p. 67; 1877, p. 429; Eliot, 1904, p. 404; Vayssière, 1912, p. 25.

Fracassa tuberculosa Eliot, 1903, p. 371; 1910, p. 432.



FIGS. 23–26. *Orodoris miamirana. 23,* Dorsal view of preserved slug. *24,* Ventral view of same. *25,* Radular teeth. *26,* Diagram of reproductive organs. (*a*) Ampulla, (*b*) spermatheca, (*d*) male duct, (*i*) insemination duct, (*m*) female gland mass, (*r*) prostatic duct, (*s*) spermatocyst, (*t*) sheathed male duct, (*v*) vagina, (*w*) atrium.

Orodoris striata Eliot, 1904, p. 268; 1910, p. 432.

RANGE: Red Sea, East Africa, Seychelles, Sulu Sea, Bismarck Archipelago, Society Islands.

COLLECTING STATION: Society Islands: west of Point Tiva, Huahine, in 1.3 m, white sand and algae, February 18, 1965, R. L. Sixberry, 1 specimen (USNM 576151).

DESCRIPTION: The animal is ivory, with no traces of pigment, 25 mm long, 19 mm broad, and 10 mm high. The somewhat rolled hyponotum extends 7 mm beyond either side of the 7 mm wide foot. There are no spicules. The notum is vaulted, and 7 soft knobs form a kind of median crest, 2 of these behind the gills which lie far in front. The lateral notal knobs are symmetrical. The diameter of all knobs is about 2 mm. The thick mantle border is curved to the ventral side; it has a sharp edge and a languet of about 36 bosses around its periphery. The foot is narrow; the bilabiate anterior pedal border has a notched upper lip and peculiar folds, perhaps due to preservation, behind the under lip.

The head is dilated into a kind of veil which comprises the furrowed tentacles. The hyponotum is bulged behind the tentacles, but they are not connected with the foot. The rhinophores have a long shaft and a short club with 25 foliations. There are 5 pluripinnate gills. The anal papilla lies behind the middle of the branchial circle. An atrial fold (*w*) stands out of the genital aperture.

The buccal mass is 7 mm long; the labial cuticle measures 2 mm in anteroposterior direction, its hind border emarginate; ventrally it is continuous. The labial elements are curved rodlets, some of them curved twice. They are up to 90μ long, 5–7μ thick, so that their total number may reach 160,000. The radula is 7 mm long and 4 mm broad, and comprises 90 rows of 81 teeth per half-row, which are of rather uniform size. The innermost tooth has one big inner and several small outer denticles. The following teeth have at first outer denticles, and then an outer ridge, which disappears after the 15th tooth. The outermost teeth degenerate.

The thickened glandular inner section of the male duct (Fig. 26 *r*) corresponds to what

Bergh called "prostata nulla." The ectal part of the male duct (*d*) winds in a muscular sheath (*t*) and ends unarmed as an acrembolic male organ in a ciliated atrium. The seminal reservoirs (*b, s*) are in typical vaginal arrangement; the insemination duct (*i*) leaves the receptaculum beside the entrance of the vagina (*v*).

REMARKS: The diagnosis of *Orodoris* in Thiele (1931, p. 433) is based upon Bergh's and stresses the notal sculpture, the central ridge, and the transverse ribs of the notum. Eliot (1910, pp. 431, 432) also described these characters. Vayssière's diagnosis (1912, p. 25) mentions only tubercles, and vestigial color marks between them, which vanished in alcohol. Vayssière does not report any ridges. Eliot (1904, p. 269) also found very different-looking preserved specimens. Evidently the sculpture is considerably altered by the preservative.

The variability of the radular denticulation both in strength of the denticles and in their occurrence toward the outer part of the half-row is revealed by the various descriptions. Vayssière's material represents the maximum of denticulation; Bergh's and ours, the minimum.

The interrupted median thickening, also called spurious rhachidian teeth, occurs only in Bergh's animal; we have observed a similar ridge as an inconstant character in species of *Discodoris*.

Peronodoris rehderi, new species
Figs. 27–30

COLLECTING STATION: Society Islands: 31.5 km south of Papara, Tahiti, in 0.1 ft, March 17, 1963, H. A. Rehder, 1 specimen (USNM 575988).

DESCRIPTION: The animal is colorless, whitish, 9 mm long, 5 mm broad, and 3 mm high. The foot which is shorter than the mantle is 2.8 mm wide. The consistency is soft. Some spicules are preserved. The slight notal ridges form a rather symmetrical network; in Figure 27 they are exaggerated. The rims of the rhinophoral pits and the branchial pocket are smooth; the rhinophores and the gills are not well preserved, but probably there were 6 gills. The tentacles are triangular; the anterior pedal border is notched.

The labial cuticle is smooth. The formula of the radula is 28 × 2–3.35.0.35.2–3. The innermost tooth has 2 outer denticles. The number of these increases to 9 in the following teeth. The 2 to 3 outermost teeth are of the pectinate or, better, setaceous type, bearing 20 or more fine bristles. In some marginal teeth a wider cusp accompanies the brush.

Of the inner organs only the very hardened female gland mass and a receptaculum with parallel sperms were seen. Further ectally we distinguished the penis with a curved, 60μ-long stylet (Fig. 30) and a hollow spine, 90μ long, in a papilla (Fig. 29) which probably belongs to a vestibular gland.

The species is named for the collector.

REMARKS: *Peronodoris* Bergh, 1904, comprises only 2 species if we do not include *Sclerodoris* Eliot, 1904, as Thiele (1931, p. 435) and several Australian authors do. When we studied a species of *Sclerodoris* from Madagascar, the actual name of which is *Atagema osseosa* (Kelaart, 1859), we based our separation of *Sclerodoris* and *Peronodoris* on the penial stylet of the latter.

As there is no figure of an entire animal of the genus *Peronodoris,* our comparison of *P. rehderi* can consider only the radula and the reproductive organs. *P. cancellata* Bergh (1904, p. 45) from the Pacific Ocean has no prostate, but this character is not known for *P. denticulata* Eliot (1908, p. 115) from the Red Sea and for the present species. Therefore, the generic positions of *P. denticulata and P. rehderi* are not settled yet.

The absence of denticles on the teeth, a character of the Archidoridinae (Odhner, 1926, p. 54), is valid for the type species of *Peronodoris* but not for *P. denticulata* and *P. rehderi,* but an emendation of this kind can hardly be avoided when other species are assigned to a monotypic genus.

P. rehderi differs from the older species of *Peronodoris* by the setaceous marginal teeth and by a spine of a vestibular gland. *P. cancellata* has no denticles on the inner teeth; *P. denticulata* has 1 or 2 denticles on the inner 4 to 7 teeth.

Sebadoris crosslandi (Eliot, 1903)

Sebadoris crosslandi Marcus and Marcus, 1960, p. 905 (references).

RANGE: Indian Ocean from the Red Sea and Africa to the Banda Sea.

COLLECTING STATION: Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 2 specimens (USNM 576435).

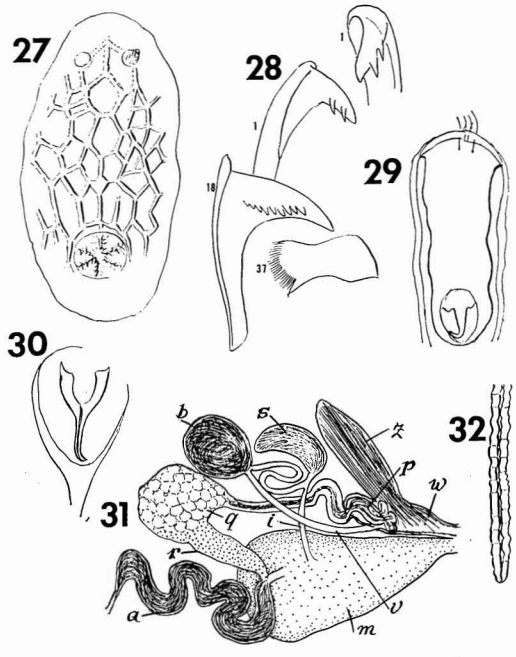
REMARKS: The present specimens of *S. crosslandi,* the first record of this species from the Pacific, come from the neighborhood of the original locality of *Doris nubilosa* Pease, 1872—the Society Islands. This occasions a new consideration of the priority of Pease's name. Allan (1947, p. 456, pl. 42, fig. 20), stressed the branched papillae with simple ones between them in *D. nubilosa.* Branched papillae, also known in the otherwise very different *Otinodoris winckworthi* White (1948, fig. 7), do not occur in the present specimens. Furthermore, the color pattern of the ventral side in Pease's species (Allan, 1947, pl. 42, fig. 18) is not identical with that of Eliot's (1903, pl. 32, fig. 3; Marcus and Marcus, 1960, fig. 47). The identity of *Diaulula gigantea* Bergh (1905*a,* p. 119) with *Sebadoris crosslandi,* already established by Eliot (1906, p. 656), needs no further comment.

Tayuva ketos juva, new subspecies
Figs. 31–32

COLLECTING STATION: Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 1 specimen (USNM 576430).

DESCRIPTION: The animal is 23 mm long, 14 mm broad; the right mantle border is damaged. The sole is 17 mm long, 6 mm wide; its anterior border is bilabiate and notched. The light grayish brown color is brought about by scattered melanophores which form denser blotches here and there. The shafts of the rhinophores and the gills contain dots of pigment. The hyponotum and the sole are ivory.

The notal papillae are of different size and supported by spicules which rarely project over the tips. The papillae which are not caryophyllidia occur also on the borders of the rhinophoral pits and the rims of the branchial pocket. There are about 25 foliations of the rhinophores and 6 multipinnate gills. The tentacles are pointed cones.



FIGS. 27–30. *Peronodoris rehderi,* n. sp. *27,* Dorsal view of preserved slug, sculpture exaggerated. *28,* Radular teeth. *29,* Penis. *30,* Spine of accessory gland.
FIGS. 31–32. *Tayuva ketos juva,* n. subsp. *31,* Diagram of reproductive organs. *32,* Bristle from bristle sac.
(*a*) Ampulla, (*b*) spermatheca, (*i*) insemination duct, (*m*) female gland mass, (*p*) penis, (*q*) prostate, (*r*) prostatic duct, (*s*) spermatocyst, (*v*) vagina, (*w*) vestibule, (*z*) bristle sac.

The labial cuticle bears two triangular areas, 0.3 mm in an anteroposterior, and 0.8 mm in a dextro-sinistral direction. The rodlets on these areas are 40–60μ long and 8μ in diameter. The radula measures 2.3 × 2.1 mm, has 20 rows and 28 teeth per half-row. The teeth are hook-shaped; the innermost tooth is 70μ high, in the middle of the half-row the teeth reach 210μ, the 3–4 outer ones are smaller. The short salivary glands are bent forward; the stomach is free; the blood glands are white.

Ectally to the winding ampulla (Fig. 31 *a*) the inner oviduct and the spermiduct separate. The latter begins as a glandular (*r*) light gray ribbon with big cells, then becomes a massive, yellowish prostate (*q*). The epithelium of the following, narrower duct is still glandular. The

male duct (*d*) ends in the penis sheath with a penial papilla 1 mm long, 0.2 mm thick (*p*). Its lumen is folded and its end widened. The sheath opens into the common vestibule (*w*), whence the vagina (*v*) originates, and into a long diverticulum (*z*), which lodges a thick bundle of rugged bristles 2 mm long, 8μ in diameter. The sperm-storing vesicles are disposed serially (*b, s*).

REMARKS: The present form is very near to the two other subspecies, *Tayuva ketos ketos* from the Gulf of California (Marcus and Marcus, 1967, p. 192), and *T. k. gila* from Curaçao (Marcus and Marcus, in press), both with some melanophores on the underside. An evidently systematic difference lies in the bristles of the vestibular sac, which are smooth in both American forms. Their dark blood glands are probably not a valuable taxonomic character; in *Platydoris* intraspecific differences in the color of the blood glands are known.

Platydoris scabra (Cuvier, 1804)

Platydoris scabra Marcus and Marcus, 1960, p. 907 (references).

RANGE: Indo-West Pacific Ocean from the Red Sea and East Africa to Tonga and the Samoan Islands.

COLLECTING STATIONS: Tonga Islands: Niutoua, east end of Tongatabu, fringing reef, under coral, July 8, 1964, H. A. Rehder, 1 specimen (USNM 576027); Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 1 specimen (USNM 576436).

DESCRIPTIVE NOTES: The preserved specimen from Rurutu is 80 mm long, 50 mm broad. Its consistency is very hard, and the notum is full of spicules. The color corresponds to our last description and figure (Marcus and Marcus, 1960, p. 908, fig. 55). There are about 35 rhinophoral foliations, 5 tripinnate gills with white rhachises, and high, undulate borders of the branchial pocket. The blood gland is white. The labial cuticle is smooth. The radula has about 50 rows and 127 teeth per half-row. Irregular indentions of the cusp occur on the 2 to 3 outermost teeth; the cusps of the next 5 teeth inward are blunt. The further teeth have pointed cusps.

As in our previous description, the male duct originating from the ampulla passes through the prostate; in the adult specimen at hand the entrance and exit are even further distant from one another than in the young specimen from the Red Sea (Marcus and Marcus, 1960, fig. 57). An independent prostatic duct (White, 1950, fig. 15) was not confirmed. The present animal has cuticular plates, many of them with spines, in the ejaculatory duct and in the vagina. The insemination duct opens into the outer part of the oviduct, the nidamental duct, not into the mucus gland as in our previously described specimen.

The specimen from the Tonga Islands is small, 17 mm long, 14 mm broad, and less vividly colored than other animals of this species. Its radula has 50 rows and 70 teeth per half-row. Irregular cusps of the outermost teeth, as occur in the present specimen, were mentioned by Bergh (1880, pp. 61, 63) for two species from the Tonga Islands, today considered as synonyms of *P. scabra.* This serrulation however, is not specific. The blood glands are black, but intraspecific differences in their color are also known for *P. speciosa* (White, 1950, p. 93). The penis bears spines, the vagina a strongly folded cuticle.

Pupsikus, new genus

Doridídae (Platydoridinae) with a ridge connecting the tentacles with the foot, with a labial armature of rodlets, and a radula containing denticulate lateral and feathered marginal teeth. Prostate voluminous, penis spiny, vestibular gland with stylet. Seminal reservoirs serial.

TYPE SPECIES: *Pupsikus pinguis,* new species

A flap between tentacles and foot is known in the systematically far distant genera *Trippa* Bergh, 1877, and *Hallaxa* Eliot, 1909, both without prostate and penial spines. In *Carminodoris,* as described by Bergh (1889, p. 218; 1905*a,* p. 111), labial rodlets, denticulate laterals, prostate, and spiny penis are present, but not feathered marginals.

Eliot (1910, p. 419) considered that *Carminodoris* might have to be united with the older *Artachaea* Bergh (1882, p. 231). But the type species of the latter has a smooth labial cuticle, and differs in this way from *Carminodoris.* It

is doubtful whether *Artachaea* belongs to a group of genera or a subfamily with a strong prostate. Judging from *A. intermedia* Eales (1938, p. 107) the prostate is in fact more than a dilated ental part of the male duct, because it is "large and wrapped around the spermatheca" (text fig. 23). White (1950, pp. 98–100) does not mention the prostates of her species of *Artachaea* but correctly maintains the unarmed lips as a character of the genus.

The genus is named for our friend Dr. Alexander Pupsik.

We allot *Pupsikus* to the Platydoridinae because all its characters, except the mentioned ridge, occur in this subfamily, though in different combinations.

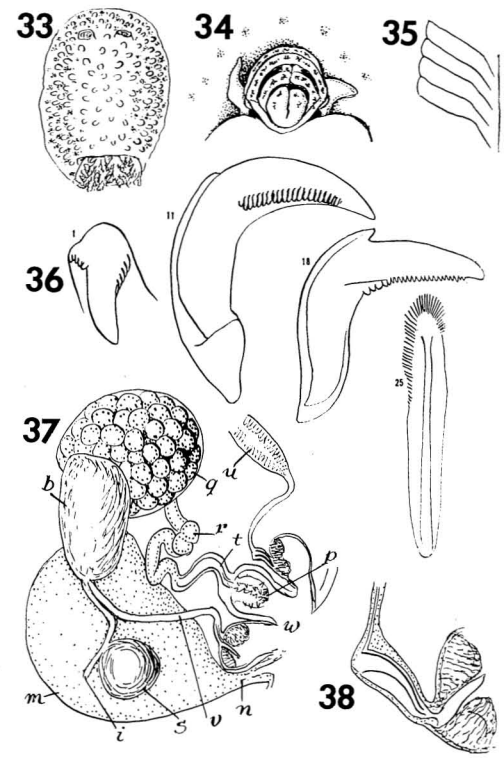
Pupsikus pinguis, new species
Figs. 33–39

COLLECTING STATION: Society Islands, Mitirapa, Tahiti, 1964, R. L. Sixberry, 1 specimen (USNM 576010).

DESCRIPTION: The preserved specimen, when straightened, is 9 mm long, 7 mm broad, and 4 mm high. The middle of the back is damaged. The papillae of the notum are soft blunt tubercles, about 0.2 mm in diameter, and a little farther apart from one another. The notal spicules enter the papillae but do not project. The number of papillae decreases toward the sides where they are mixed with dark flecks of pigment. The white hyponotum is smooth. The rims of the rhinophoral pits are salient and without tubercles. The smooth border of the branchial pocket is distended.

The short conical tentacles are connected with the anterior border of the foot by ridges. The mouth is encircled by 3 folds bearing rows of brown chromatophores. The shaft and the 15 foliations of the rhinophores are pigmented. Also the anal papilla, which completes the circle of the 6 gills behind, contains brown pigment. The breadth of the foot is less than one-third the total width. The dorsal side of the foot is loosely pigmented; the sole is white. The anterior pedal border is bilabiate, not notched.

The labial cuticle bears delicate rodlets, about 40μ high and 9μ in diameter. The radula contains 28 rows and 27 teeth per half-row. Of these the 19 inner teeth are hooks, the 8 outer ones flat plates with edges feathered farther down on the outer side than on the inner. The innermost hook bears 3 to 5 denticles on the inner, and 5 or more on the outer side. The next 18 teeth have only outer narrow denticles, 20 or more in number. The stomach is free from the digestive gland, as far as the dorsal defect allows one to see.



FIGS. 33–38. *Pupsikus pinguis,* n. g., n. sp. *33,* Preserved slug. *34,* Head. *35,* Labial elements. *36,* Radular teeth. *37,* Diagram of reproductive organs. *38,* Vestibular spine.
(*b*) Bursa, (*i*) insemination duct, (*m*) female gland mass, (*n*) nidamental canal, (*p*) penis, (*q*) prostate, (*r*) prostatic duct, (*s*) spermatocyst, (*t*) sheathed male duct, (*u*) vestibular gland, (*v*) vagina, (*w*) vestibule.

The ampulla is long. The prostate (Fig. 37 *q*) is massive, racemose, about 1.2 mm long, and 0.6 mm in diameter. The spermiduct begins as a glandular organ (*r*) and then is sheathed by a muscle layer (*t*). The 0.3 mm long penial papilla (*p*) in the atrium (*w*) contains cuticular spines (Fig. 39) which stand on the outer side of the everted part of the ejaculatory duct.

The biggest spines are 25μ high and 25μ wide at their base.

The vagina is about 1.8 mm long (Fig. 37 *v*). It begins between the glands of an atrial pouch and leads to the bursa (*b*). The insemination duct (*i*) leaves the bursa just beside the entrance of the vagina. The receptaculum seminis (*s*) is apposed to this duct without a special canal. The duct continues and enters the female gland mass (*m*), the nidamental canal (*n*) of which opens behind the atrium. Another glandular atrial pouch receives the long narrow duct of a high-celled vestibular gland (*u*). The outer end of this duct lodges a stylet, 100μ long and 15μ wide in the middle (Fig. 38).

Gymnodoris citrina (Bergh, 1877)
Fig. 40

Trevelyana citrina Bergh, 1877, p. 442, pl. 41, fig. 5 (1875), pl. 56, figs. 18–25; Eliot, 1900, p. 520.
Gymnodoris japonica Baba, 1930; 1935, p. 334.
Gymnodoris citrina Baba, 1937*a*, p. 292, pl. 1, fig. 9; 1949, pp. 40, 135, text-fig. 35, pl. 11, figs. 37, 38.
Gymnodoris bicolor (? non Alder and Hancock, 1864, p. 440) Marcus and Burch, 1965, p. 249.
Gymnodoris citrina Young, 1967, p. 169, figs. 16–18.

RANGE: Central Japan; Palau Islands; Eniwetok Atoll, Marshall Islands; probably South China Sea (Risbec, 1956, fig. 68) and New Caledonia (Risbec, 1953, fig. 57).

COLLECTING STATIONS: Society Islands: Mitirapa, Tahiti, 1964, R. L. Sixberry, 1 specimen (USNM 576012); west tip of Point Tiva, Huahine, in white sand, algae, February 18, 1965, R. L. Sixberry, 1 specimen (USNM 576152).

DESCRIPTIVE NOTES: The preserved animal from Huahine is 19 mm long and 12 mm broad and high; it has soft and pointed cutaneous papillae on the everted area between mouth and tentacles (Fig. 40). Its radula formula is 29 × 35.1.0.1.35. The animal from Mitirapa, 18 mm long, 8 mm high, and 7 mm broad, has 22 rows with 30 lateral hooks per half-row. Both have a 390–430μ-high innermost lateral tooth, about twice as high as the second tooth. The broad base and the awl-shaped cusp of the latter is a useful specific character (Young, 1967). The buccal mass of the present specimens is voluminous in the animal from Mitirapa, 7.5 mm long, 4.5 mm high, and 3.5 mm broad.

REMARKS: Young's recent separation of *G. bicolor* (Alder and Hancock, 1864) and *G. citrina* was the deciding factor in our choice of a name for the specimens at hand. A young slug from Madagascar, 2.5 mm long alive, which we recently classified as *G. bicolor,* has an innermost lateral tooth 52μ long, and the second one 40μ long. This agrees with Young's statement that the innermost lateral of *G. bicolor* is much smaller than that of *G. citrina* of comparable size.

Eliot (1904, p. 89) recorded an East African animal, doubtfully, as *G. bicolor.* His description of the innermost tooth of the radula as large and hamate, and the following tooth much like it suggests that his classification was right.

Young has seen material of *G. bicolor* also from Hawaii, so that the two species are evidently not separated geographically. Hence the range of *G. citrina* can be given only with caution.

Gymnodoris striata (Eliot, 1908)
Fig. 41

Trevelyana striata Eliot, 1908, p. 100; Vayssière, 1912, p. 61.
Analogium striatum Risbec, 1928, p. 193; 1953, p. 101.
Gymnodoris striata O'Donoghue, 1929*a*, pp. 809–811; Baba, 1937*b*, p. 216; 1960, p. 71.

RANGE: Suez Canal; Red Sea, Djibouti; central Japan; New Caledonia.

COLLECTING STATION: Fiji Islands: promontory east of Korolevu Bay, Kandavu, fringing reef, mostly fine sand and weeds, 1–2 m, February 24, 1966, R. Jameson, 1 specimen (USNM 576428).

DESCRIPTIVE NOTES: The preserved animal is 8.5 mm long, 5 mm high, and 4 mm broad. The transverse row in which the gills are ar-

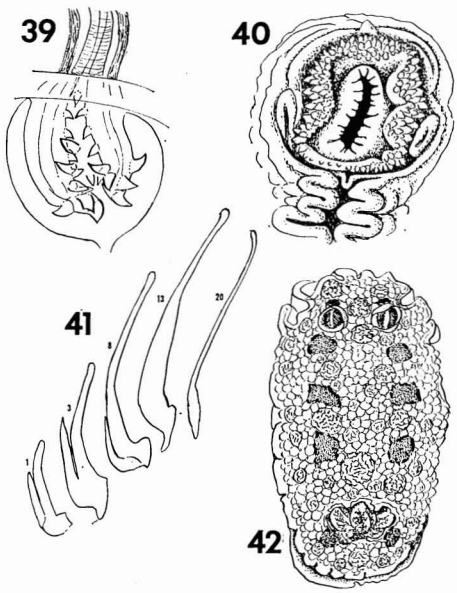


FIG. 39. *Pupsikus pinguis,* n. g., n. sp.: penis.
FIG. 40. *Gymnodoris citrina:* ventral view of head.
FIG. 41. *Gymnodoris striata:* radular teeth.
FIG. 42. *Dendrodoris denisoni:* preserved slug.

ranged seems to be debatable as a generic character because Macnae (1958, p. 355) observed this position also in a preserved specimen of *G. bicolor* which alive had the gills arranged in a wide crescent. But the rudimentary innermost tooth of *G. striata* and *G. subornata* Baba, 1960 (p. 72), which contrasts with the diagnosis of *Gymnodoris* "dens intimus fortior" (Bergh, 1905*a,* p. 188), would justify a subgeneric or generic separation of *Gymnodoris* and *Analogium* Risbec, 1928.

Dendrodoris nigra (Stimpson, 1855)

Dendrodoris nigra Marcus and Burch, 1965, p. 250 (references).

RANGE: Indo-West Pacific: Red Sea and East Africa to eastern Australia; north to Mutsu Bay, Japan; east to Onotoa, Gilbert Islands, and New Caledonia.

COLLECTING STATION: Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 1 specimen (USNM 576433). This record extends the range of this species considerably to the east.

Dendrodoris denisoni (Angas, 1864)
Fig. 42

Doris denisoni Angas, 1864 (January), p. 45.
Doridopsis gemmacea Alder and Hancock, 1864 (April), p. 126; Eliot, 1907, p. 91.
Doridopsis clavulata Alder and Hancock, 1864, p. 127; Eliot, 1904, p. 278; 1906, p. 663.
Doriopsis denisoni Bergh, 1884, p. 694.
Doridopsis denisoni Eliot, 1906, p. 662.
Doridopsis arenosa Risbec, 1930, p. 266.
Dendrodoris denisoni Allan, 1947, p. 457; 1950, p. 222.
Dendrodoris (*Dendrodoris*) *gemmacea* Baba, 1949, p. 155.
Dendrodoris (*Dendrodoris*) *denisoni* Abe, 1964, p. 56 (text in Japanese), pl. 26, fig. 93.

RANGE: East Africa (Eliot, 1904); south to Inhaca Island, Mozambique (Macnae and Kalk, 1958, p. 88); Bay of Bengal (Alder and Hancock); South China Sea (Guang-Yu and Si, 1965*a,* pl. 1, fig. 7); northward to Sagami Bay and Toyama Bay, central Japan (Baba, 1949; Abe, 1964); Queensland (Kenny, 1960, p. 225) and New South Wales (Allan), Australia; New Caledonia (Risbec).

COLLECTING STATION: Tubuai Islands: Rurutu, June 1965, R. L. Sixberry, 2 specimens (USNM 576431, 576434).

DESCRIPTION: The measurements are: length 35 and 22 mm, width 20 and 13 mm, height 11 and 8 mm. The consistency is soft, and small pustules are more or less densely disposed over the dorsal surface. Larger, though evidently contracted, knobs with wrinkled tops stand rather symmetrically on the notum. There are no spicules. The notal brim is thick and ruffled and so is the pedal border. The foot projects behind; in front it is bilabiate and passes forward on either side of the oral pore to the small tentacular flaps. The latter are separated in front of the mouth.

The color is whitish. There are five pairs of gray spots surrounded by black streaks, the first in front of the rhinophores, the last behind the gills. The shafts of the rhinophores and the

center of the gills are brownish. As these areas are the least exposed to the preservative liquid, it seems possible that this color has faded out elsewhere.

The blood gland and the peritoneum are colorless; the liver is yellow. The rhinophoral sheaths are high and smooth; the clubs bear 35 foliations. The tuberculated border of the branchial pocket has 5 lobes; the 5 gills are tripinnate; the anal papilla completes the circle of the gills behind. The central nervous system is smooth, but a more warty or more smooth surface may be due to fixation. The eyes are attached to the cerebral ganglia, which are separated by a sulcus.

The longitudinally folded pharynx projects into the oral cavity; its narrow part is precerebral. The white ptyaline gland is broad and lobate, its duct long. Behind the brain the pharynx is broad and muscular and describes a loop to the buccal ganglia. The small salivary glands are in contact with the buccal ganglia. Behind these the glandular oesophagus begins.

REMARKS: We distinguish *Dendrodoris* Ehrenberg, 1831, and *Doriopsilla* Bergh, 1880, as genera, and therefore, do not write the name in the manner of Baba (1949) and Abe (1964). There are about 80 names given to species of *Dendrodoris;* the colors of living animals and the sculpture are the principal characters described, both of which vary and suffer from the influence of preservation. The reproductive organs do not seem to be very different in the various species; moreover, they are not known for many species. The vast majority of species have been described from warm waters of the Indo-West Pacific so that a geographic viewpoint must be applied with caution.

Eliot (1907) hesitated to accept Bergh's identification (1884) of *D. gemmacea* with *D. denisoni* because the original material of *D. gemmacea* and specimens from Japan had no penial spines, which are present in *D. denisoni.* As far as is known today, these spines are a generic character of *Dendrodoris* but are occasionally wanting even in big specimens (Bergh, 1879, p. 62). The "large, compound tubercles" of *D. gemmacea,* according to Eliot, are lacking in *D. denisoni.* Today, however, "a large range from smooth to highly pustular" animals of *D. denisoni* has been observed. (Burn, 1965, p. 86).

Kenny's material (1960) agrees with Baba's Figure 100 (1949), not with his Figure 101. The latter agrees with Baba's first figure (1937*a,* pl. 1, fig. 4), with Guang-Yu and Si's (1965*a*), and with Abe's (1964). By a detailed analysis these, at first sight very different, figures (Baba, 1949, figs. 100 and 101), can be brought together. Also our material is similar to the first. We agree with Allan (1947) that "it is apparent that the two species are synonymous."

Among the many figures referring to the species mentioned in our list of synonyms, those of *D. clavulata* Alder and Hancock, 1864 (pl. 31, figs. 10–12) agree especially well with the specimens at hand. Eliot (1906, p. 663) mentioned differences between *D. denisoni* and *D. clavulata;* in our specimens the spermiduct is much coiled, both in its glandular and muscular portions. The identity of *D. arenosa* Risbec, 1930, with *D. clavulata,* and therefore probably with *D. denisoni,* has been established by Risbec himself (1953, p. 24).

GENERAL NOTES ON THE PHYLLIDIIDAE

By the position of the anus between notum and foot, *Fryeria* Gray, 1853 (Bergh, 1869, p. 514) can be separated from the remaining Phyllidiidae having a dorsal anus. If the sculpture is used for further subdivision, the quincuncial tubercles (simple or compound, but isolated and not coalesced into longitudinal bulges) occur in the type species of *Phyllidiella* Bergh (1869, p. 510) as well as in that of *Phyllidiopsis* Bergh (1876, p. 670) (Pruvot-Fol, 1957, p. 119). The oral glands are different in *Phyllidiella* and *Phyllidiopsis.* In the type species of the former they are multiple and project from the buccal mass (Bergh, 1869, pl. 21, figs. 3–6); in *Phyllidiopsis papilligera* Bergh (1890, p. 176) there is a single oral gland (Marcus and Marcus, 1962, fig. 24). The descriptions of the two older species of *Phyllidiopsis* (Bergh, 1876, p. 672; 1889, p. 866) suggest that the single oral gland was

torn off and that the blood gland lying farther behind was taken for the oral gland.

A taxonomy according to the sculpture does not conform with that based upon the oral glands. *Phyllidia* (*Phyllidia*) *tula* (Figs. 43–47) has oral glands like the type species of *Phyllidia* (Bergh, 1869, pl. 15, figs. 1, 2, 9) and isolated notal tubercles like that of *Phyllidiella.* Species as *P.* (*Phyllidiella*) *variabilis* Collingwood, 1881, show that the anatomy of the foregut must prevail over the sculpture. Similar sculptural patterns occur in *Phyllidiopsis striata* Bergh (1889, pl. 84, fig. 23) and in *Phyllidiella soria* (Fig. 53), but Bergh's description (p. 886) and figure (fig. 24), though incomplete for a *Phyllidiopsis,* can be still less easily fitted into the scheme of *Phyllidiella.*

Phyllidia* (*Phyllidia*) *tula, new species

Figs. 43–47

COLLECTING STATION: Micronesia; Nukulaelae, Ellice Islands, reef flat, northern motu, December 1, 1965, R. L. Sixberry, 2 specimens (USNM 576439).

DESCRIPTION: The animals are oval in shape, about 80 mm long and 30 mm wide, and a little broader in front than behind. They are rather flat and stiff due to the great number of spicules. The arrangement of the notal tubercles, which are not confluent, is not distinctly symmetrical (Fig. 43). They are rather high and rise gradually to the rounded top, which in the big tubercles is encircled by small warts (Fig. 44).

The ground color of the dorsum is black; the yellowish white summits of the tubercles darken gradually downward. The small warts are light. The ivory-white clubs of the rhinophores have 25 foliations; the shafts and the rhinophoral cavities are pigmented. Both the hyponotum, checkered by tracts of spicules, and the tentacles are gray. The foot also is gray, darker near the borders, and with a black median line. The gills and the genital and anal papillae are black.

The tentacles (Fig 45 *l*) have pointed tips and lateral furrows and are coalesced in the middle. Their bases are connected with the anterior foot border by crests. This border is notched, not bilabiate.

The outer mouth leads to a thin black oral tube. A ring of white folds separates this anterior oral tube from the following part (*f*), the wide pouch containing the oral glands (*j*); the enormous yellow glandular cones arise from the bottom of the buccal cavity. The buccal mass and the fundi of the glands are coated by the slightly pigmented peritoneum. A pair of strong retractors (*k*) is inserted on either side of the buccal mass. The curved tube which leaves it is the pharynx (*h*). Its ectal part is covered by the pigmented buccal peritoneum; farther behind, the pharynx is white. It narrows and passes through the nerve ring (*c*). Immediately behind the latter the buccal and the gastro-oesophageal ganglia define the end of the pharynx. The lobulate blood gland (*g*), an unpigmented, long, flat organ, lies over the brain.

REMARKS: The new species has isolated, not confluent, notal tubercles. In this respect it approaches *Phyllidia pustulosa* Cuvier, 1804, a species with small (Bergh, 1869, pl. 24, fig. 7; Baba, 1936, pl. 3, fig. 1; Guang-Yu and Si, 1965*a,* pl. 3, fig. 1), middle-sized (Baba, 1949, pl. 29, fig. 107), or big (Eales, 1938, pl. 1, fig. 4; Pruvot-Fol, 1956, p. 75) tubercles, erroneously called *pustulata.* In *P. pustulosa,* however, the rhinophores and the anterior part of the buccal mass are black, the free glands are unsymmetrical (Bergh, 1869, pp. 464–465), the rhinophores have 18–22 foliations, and the foot has no black midline (Pruvot-Fol, 1956, p. 62). Rounded tubercles encircled by small warts, as in the present specimens, have been observed, for example, in *P. ocellata* Cuvier (Bergh, 1869, p. 508), but we did not find them recorded for *P. pustulosa.*

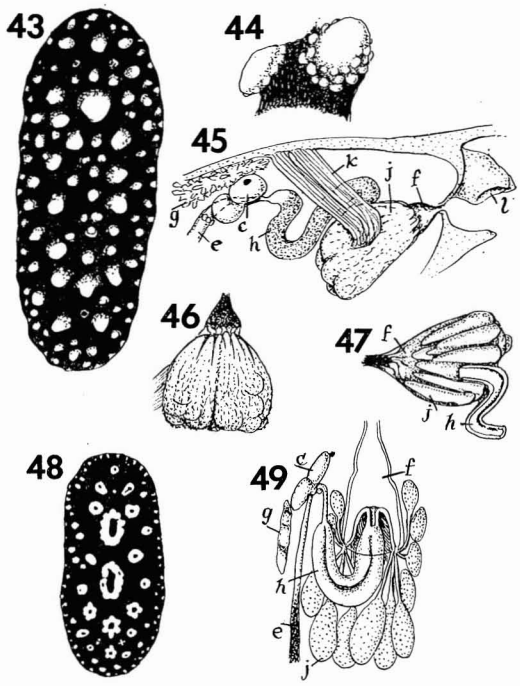
Phyllidia (*Phyllidiella*) *annulata* Gray, 1853

Figs. 48–49

Phyllidia annulata J. E. Gray, 1853, p. 220; Bergh, 1869, p. 509.

RANGE: Tuamotu Archipelago.

COLLECTING STATION: Tuamotu Archipelago: lagoon side of pass between Hikitake Island and island to south, Amanu Atoll, shallow reef, 1–3 feet, R. L. Sixberry, September 22, 1964, 1 specimen (USNM 576019).



FIGS. 43–47. *Phyllidia* (*Phyllidia*) *tula,* n. sp. *43,* Preserved slug. *44,* Notal tubercles. *45,* Lateral view of buccal mass. *46,* Ventral view of same. *47,* Lateral view of opened buccal mass.

(*c*) Brain, (*e*) oesophagus, (*f*) oral cavity, (*g*) blood gland, (*h*) pharynx, (*j*) oral glands, (*k*) retractor, (*l*) tentacle.

FIGS. 48–49. *Phyllidia* (*Phyllidiella*) *annulata. 48,* Preserved slug. *49,* Ventral view of opened buccal mass.

(*c*) Brain, (*e*) oesophagus, (*f*) oral cavity, (*g*) blood gland, (*h*) pharynx, (*j*) oral glands.

DESCRIPTION: The tongue-shaped body is 42 mm long measured over the back, and 18 mm broad. The notum and the foot are black. In life the sculpture is rose colored, as shown in a kodachrome slide furnished us; when preserved it is white. It consists of tubercles which are isolated from one another, not coalesced into longitudinal bulges. The sculptural elements are arranged rather symmetrically. One central, two slightly irregular lateral series, and a row of minute warts near the margin are distinguishable. The central series consists of 4 tubercles, one in front of the rhinophores, and the fourth in front of the anus. In the original material this pattern occurs, as well as one with a fifth tubercle behind the anus. The two foremost tubercles of the present specimen are smaller than the following ones, but all are of the compound type. They have a black center and 5–10 peripheral white elements arranged as a ring. Black centers occur also in the middle-sized tubercles of the lateral series which in part are also of the compound type. Others are simple as are the marginal warts.

Small white warts, already mentioned by the author of the species, flank the rhinophoral pits. The black club of the rhinophore bears 25 foliations; the shaft is white. The nearly black tentacles are furrowed on their outer side as in the other Phyllidiidae. They are more separated from one another than in the following species. The anterior border of the foot is deeply notched in the middle, and bilabiate. The hyponotum and the gills are gray, not black. The tissue around the still young genital aperture is black.

The peritoneum of the buccal mass and the blood gland (*g*) is slightly pigmented. The oral tube is purple immediately behind the mouth. The multiple free oral glands (*j*), each with its own duct, are dark yellow; they cover the fundus of the oral cavity (*f*). The pharynx (*h*) is thickened by 3 long glandular cushions in its wall. Posteriorly the pharynx narrows and passes through the nerve ring (*c*). The rounded blood gland (*g*) is somewhat lobed. The thin oesophagus (*e*) is black.

REMARKS: Bergh and Pruvot-Fol (1956, p. 63) knew *P. annulata* only from Gray's unillustrated description. Bergh believed that it approached *P. ocellata* Cuvier, 1804, and Pruvot-Fol considered it as a synonym of that species. The present specimen from the neighborhood of the original locality, however, proves that *P. annulata* and *P. ocellata* (Pruvot-Fol, fig. II) are quite different species.

P. multituberculata Boettger (1918, p. 129), which escaped Pruvot-Fol's notice, is near *P. ocellata.*

Phyllidia (*Phyllidiella*) *variabilis* (Collingwood, 1881)
Figs. 50–52.

Fryeria variabilis Collingwood, 1881, p. 137, pl. 10, figs. 24–28.

Phyllidia bourgini Risbec, 1928, p. 57, f. 2, pl. 1, fig. 1; 1953, p. 12, fig. 3.

Phyllidia variabilis Risbec, 1956, p. 24, fig. 85.
Phyllidia varians (err. pro *variabilis*) Pruvot-Fol, 1956, p. 68.

RANGE: Vietnam, Nhatrang (12°16′N); west coast of Borneo; New Caledonia.

COLLECTING STATION: Tubuai Islands: Tubuai, June 1965, R. L. Sixberry, 2 specimens (USNM 576438).

DESCRIPTION: The sole-shaped animals are a little broadened in the anterior third. They are 25 mm long, 10 mm broad, and 5 mm high. In life they were black with pink warts, which are white in the preserved state. The warts are compound near the middle, single around the margin, and arranged rather symmetrically. Longitudinal bulges formed by coalesced warts are not developed in the present specimens.

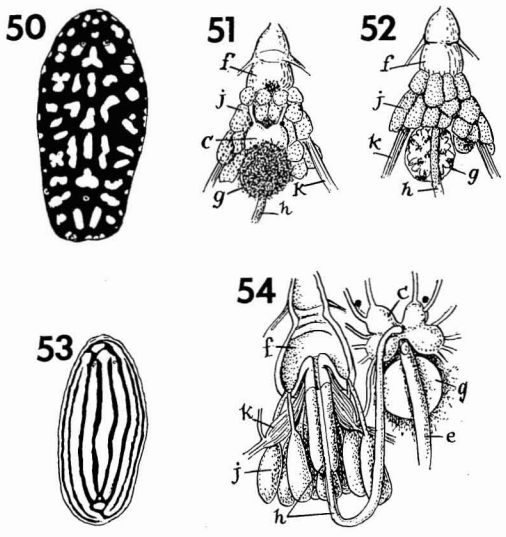
The black rhinophores have 18–20 foliations; the genital apertures, the tentacles, hyponotum, and gills are white. The slightly pigmented sole is criss-crossed by silvery spicules. The tentacles are furrowed on their outer side, united with one another, and connected with the anterior foot border which is entire, not notched.

The oral tube widens immediately behind the mouth. The free oral glands (*j*) are numerous and rather small, covering the fundus of the oral cavity (*f*); between them the retractors (*k*) are inserted. The pharynx begins with three short glandular cushions in its wall. Farther behind, the pharynx continues as a narrow tube (*h*) which passes through the nerve ring (*c*). The blood gland (*g*) is discoid, its borders lobulate. The gland is wrapped in pigmented connective tissue.

REMARKS: The free multiple oral glands define the subgeneric place of this species. The sculpture is not uniform, the original figure and the present one show single and compound tubercles which are isolated and do not form bulges, while Risbec's drawings of *P. bourgini* show longitudinal bulges.

Phyllidia (Phyllidiella) soria, new species
Figs. 53–54

COLLECTING STATION: Society Islands: Mitirapa, Tahiti, 1964, R. L. Sixberry, 1 specimen (USNM 576008).



FIGS. 50–52. *Phyllidia (Phyllidiella) variabilis.* *50,* Preserved slug. *51,* Dorsal view of buccal mass. *52,* Ventral view of same.
(*c*) Brain, (*f*) oral cavity, (*g*) blood gland, (*h*) pharynx, (*j*) oral glands, (*k*) retractor.
FIGS. 53–54. *Phyllidia (Phyllidiella) soria,* n. sp. *53,* Preserved slug. *54,* Opened buccal mass, dorsal view, brain laid to the side.
(*c*) Brain, (*e*) oesophagus, (*f*) oral cavity, (*g*) blood gland, (*h*) pharynx, (*j*) oral glands, (*k*) retractor.

DESCRIPTION: The specimen is longish oval, broadest in the middle, narrowing toward both ends. It measures 20 mm in length, 9 mm in breadth, and 4 mm in height.

The color is fundamentally white with 8 longitudinal black stripes on the dorsum. The 9 white bulges which consist of vestigial tubercles stand out over the black bands. The white midline is broadened in front where it touches the adjacent white stripes. The innermost black lines are confluent in front of the anal opening. The rhinophores are black; their pockets open in the paramedian white bands. The second black ring is complete and encloses a white spot behind the anus. A similar white spot is inserted between the lateral white bulges in front. These bulges are divided longitudinally by a black line and separated from the white margin by a narrow strip of black.

The rhinophores have a black club with 11 foliations and a white shaft. The hyponotum is white; a black band shining through from

the dorsum is crossed by the white gills. The tentacles, sole, and gonopore are white. Some black pigment is located in the connective tissue around the compact flat blood gland situated over and behind the brain. The pointed tentacles are furrowed on their outer side, united in front of the mouth, and connected to the slightly notched anterior foot border by high folds.

The white oral tube is fastened to the body wall by strands. It is thrown into transverse folds, and a cone projects into its cavity (Fig. 54 *f*). This is surrounded by the openings of many oral glands (*j*). These hang free backward from the oral tube. Each gland consists of a yellowish multicellular mass and a white muscular duct. Between the glands two strong retractors (*k*) are inserted. The pharynx (*h*) leaving the buccal cavity at the top of the cone begins with a glandular part. Its wall lodges 1 ventral and 2 dorsal cushions of glands. Further on, the pharynx narrows, bends forward and passes through the nerve ring (*c*). Here lie the buccal ganglia which mark the beginning of the thin oesophagus (*e*).

REMARKS: The fewer notal stripes and the dark oral tube and sole in *Phyllidiopsis striata* Bergh (1889, p. 866) are slight indications of the difference between that species and the present one. Much more important is the structure of the fore-gut. In *Phyllidiella soria* it is fundamentally different from Bergh's description of *striata.* The latter is compatible with a *Phyllidiopsis,* the single oral gland of which was torn off, while the blood gland has been taken for the oral gland.

ZOOGEOGRAPHIC REMARKS

Three of the seven new taxa of the present collection have clear relationships with Indo-West Pacific species. These are *Noumea norba, Peronodoris rehderi,* and *Phyllidia tula.* A fourth new South Pacific form, *Tayuva ketos juva,* is related to forms from other regions. The two other subspecies of *T. ketos* occur in the Gulf of California and at Curaçao. The species is a well delimited natural unit. It seems to be one of the few opisthobranch taxa with a trans-Pacific range. The number of known specimens of *T. ketos,* however, is small.

Of the 17 old species 9 belong to the widely distributed Indo-West Pacific opisthobranch fauna, 8 of them occurring also in the Red Sea. *Gymnodoris citrina* and *Phyllidia variabilis* are not included in this category because they are not recorded from the western Indian Ocean.

Of the old species, two were hitherto mentioned only from the Society Islands and one from the neighboring Tuamotu Archipelago.

The East Pacific deep sea barrier between Polynesia and the American Pacific coast has been overcome by *Dolabella auricularia* which occurs from the Red Sea to the east coast of the Pacific. Of the two circumtropical and circumsubtropical species, *Dolabrifera dolabrifera* and *Stylocheilus longicauda,* only the latter has reached the Gulf of California. Thither it may have come in the Pliocene by the intercommunication between the western Atlantic and eastern Pacific oceans, or like *Dolabella auricularia,* across the Pacific.

LITERATURE CITED

ABE, TAKEO. 1964. Opisthobranchia of Toyama Bay and adjacent waters. Tokyo. ix + 99 pp., 36 pls.

ALDER, JOSHUA, and ALBANY HANCOCK. 1864. Notice on a collection of nudibranchiate Mollusca made in India, etc. Transactions of the Zoological Society of London, vol. 5, no. 3, pp. 113–148, pls. 28–33.

ALLAN, JOYCE K. 1947. Nudibranchia from the Clarence River Heads, North Coast, N.S.W. Records of the Australian Museum, vol. 21, no. 8, pp. 433–463, pls. 41–43.

——— 1950. Australian shells. Melbourne. xix + 470 pp., 112 figs., 44 pls.

ANGAS, GEORGES FRENCH. 1864. Description d'espèces nouvelles appartenant à plusieurs genres de mollusques nudibranches des environs de Port Jackson (Nouvelle Galles de Sud), etc. Journal de Conchyliologie, vol. 12, pp. 43–70, pls. 4–6.

BABA, KIKUTARO. 1935. Nudibranchia of Mutsu Bay. Science Reports from Tōhoku University, ser. 4 (Biology), vol. 10, no. 2, pp. 331–360, pls. 5–7.

——— 1936. Opisthobranchia of the Ryukyu (Okinawa) Islands. Journal, Department of

Agriculture, Kyushu Imperial University, vol. 5, pp. 1–50, pls. 1–3.

——— 1937*a*. Opisthobranchia of Japan (II). Journal, Department of Agriculture, Kyushu Imperial University, vol. 5, no. 7, pp. 289–344, pls. 1–2.

——— 1937*b*. Record of a nudibranch, *Gymnodoris striata* (Eliot), from Amakusa, Japan. Zoological Magazine, Tokyo, vol. 49, no. 6. (Not seen.)

——— 1938. Opisthobranchia of Kii, Middle Japan. Journal, Department of Agriculture, Kyushu Imperial University, vol. 6, no. 1, pp. 1–19.

——— 1949. Opisthobranchia of Sagami Bay, etc. Iwanami Shoten, Tokyo. 194 + 7 pp., 50 pls.

——— 1953. Three new species and two new records of the genus *Glossodoris* from Japan. Publications of the Seto Marine Biological Laboratory, vol. 3, no. 2, pp. 205–211, 6 figs.

——— 1960. The genera *Gymnodoris* and *Nembrotha* from Japan. Publications of the Seto Marine Biological Laboratory, vol. 8, no. 7, pp. 71–74, pl. 1.

BERGH, RUDOLPH. 1869. Bidrag til en Monografi af Phyllidierne. Naturhistorisk Tidsskrift, ser. 3, vol. 5, pp. 358–542, pls. 14–15.

——— 1875. Neue Nacktschnecken der Südsee, III. Journal des Museum Godeffroy, vol. 8, pp. 53–100 (185–232), pls. 7–11.

——— 1876. Neue Beiträge zur Kenntnis der Phyllidiaden. Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien, vol. 25 (1875), pp. 659–674, pl. 16, figs. 5–15.

——— 1877. Malacologische Untersuchungen. In: C. Semper, ed., Reisen im Archipel der Philippinen. Band 2, Heft 11, pp. 429–494, pls. 54–57.

——— 1879. Neue Nacktschnecken der Südsee, IV. Journal des Museum Godeffroy, vol. 14, pp. 1–50, pls. 1–5.

——— 1880. Malacologische Untersuchungen. In: C. Semper, ed., Reisen, etc., Band 4, Suppl. zu Heft 1, pp. 1–78, pls. A–F.

——— 1882. Beiträge zur Kenntnis der japanischen Nudibranchien. Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien, vol. 31 (1881), pp. 219–254, pls. 6–10.

——— 1884. Malacologische Untersuchungen. In: C. Semper, ed., Reisen, etc., Band 3, Heft 15, pp. 647–754, pls. 69–76.

——— 1889. Nudibranchien vom Meere der Insel Mauritius. Malacologische Untersuchungen. In: C. Semper, ed., Reisen, etc., Band 3, Heft 16(2), pp. 815–872, pls. 82–84.

——— 1890. Report on the nudibranchs. Reports on the results . . . Steamer "Blake." Bulletin of the Museum of Comparative Zoology, Harvard, vol. 19, no. 3, pp. 115–181.

——— 1897. Malacologische Untersuchungen. In: C. Semper, ed., Reisen, etc., Band 5, Heft 4, pp. 1–115, pls. 1–8.

——— 1900. Die Opisthobranchien. Ergebnisse einer Reise nach dem Pacific. Zoologische Jahrbücher, Jena, Abt. 1, Systematik, etc., vol. 13, pp. 207–246, pls. 19–21.

——— 1902. Gasteropoda Opisthobranchiata. Danish Expedition to Siam. K. Danske Videnskabernes Selskabs Skrifter, ser. 6, Nat. Math. Afd., vol. 12, no. 2, pp. 159–218, pls. 1–3, 1 map.

——— 1905*a*. Die Opisthobranchiata der Siboga-Expedition. Siboga Expedition, vol. 50, pp. 1–248, pls. 1–20.

——— 1905*b*. Malacologische Untersuchungen. In: C. Semper, ed., Reisen, etc., Band 6, Heft 2, pp. 57–116, pls. 5–8.

BOETTGER, CAESAR R. 1918. Die von Dr. Merton gesammelten Wassermollusken. Abhandlungen hrsg. von der Senckenbergischen Naturforschenden Gesellschaft, vol. 35, pp. 125–145, pls. 8–9.

BURN, ROBERT. 1957. On some Opisthobranchia from Victoria. Journal of the Malacological Society of Australia, vol. 1, pp. 11–29, pls. 1–3.

——— 1961. A new doridid nudibranch from Torquay, Victoria. Veliger, vol. 4, no. 2, pp. 55–56, pl. 15.

——— 1962. On the pleurobranch subfamily Berthellinae, etc. Memoirs of the National Museum, Melbourne, vol. 25, pp. 129–148, pls. 1–2.

——— 1965. A centennial commentary and zoogeographical remarks on Angas' Sydney nudibranchs (Mollusca, Gastropoda). Journal de Conchyliologie, vol. 104, pp. 85–93.

——— 1966*a*. On three new Chromodoridinae

from Australia. Veliger, vol. 8, pp. 191–197, 8 figs.

——— 1966*b*. Notes on some opisthobranchs mainly from South Australia. Records of the South Australian Museum, vol. 15, no. 2, pp. 329–352, 34 figs.

COLLINGWOOD, CUTHBERT. 1881. On some new species of nudibranchiate Mollusca from the eastern seas. Transactions of the Linnean Society of London (Zoology), vol. 2, no. 2, pp. 123–140, pls. 9–10.

EALES, NELLIE B. 1938. A systematic and anatomical account of the Opisthobranchia. Scientific Reports of the John Murray Expedition, vol. 5, no. 4, pp. 77–122, pl. 1.

——— 1944. Aplysiids from the Indian Ocean, etc. Proceedings of the Malacological Society of London, vol. 26, pp. 1–22.

ELIOT, CHARLES N. E. 1900. Notes on tectibranchs and naked mollusks from Samoa. Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 51, pp. 512–523, pl. 19.

——— 1903. On some nudibranchs from East Africa and Zanzibar, Parts 2 and 3. Proceedings of the Zoological Society of London, 1903 (1), pp. 250–257; (2), 354–385, pls. 32–34.

——— 1904. On some nudibranchs from East Africa and Zanzibar. Proceedings of the Zoological Society of London, 1904 (2), pp. 83–105, pls. 3–4.

——— 1906. On the nudibranchs of southern India and Ceylon, etc. Proceedings of the Zoological Society of London, 1906, pp. 636–691, 999–1008, pls. 42–47.

——— 1907. Nudibranchs from the Indo-Pacific, III. Journal of Conchology, vol. 12, pp. 81–92.

——— 1908. Notes on a collection of nudibranchs from the Red Sea. Journal of the Linnean Society (Zoology), vol. 31, pp. 86–122.

——— 1910. Nudibranchs collected by Mr. Stanley Gardiner from the Indian Ocean in H.M.S. Sealark. Transactions of the Linnean Society, London, ser. 2 (Zoology), vol. 13, pp. 411–438, pl. 25.

ENGEL, HENDRIK. 1942. The genus *Dolabella*. Zoölogische Mededeelingen, vol. 24, pp. 197–239.

ENGEL, HENDRIK, and J. NIJSSEN-MEYER. 1964. On *Glossodoris quadricolor* (Rüppell and Leuckart, 1828) (Mollusca, Nudibranchiata). Beaufortia, vol. 11, no. 132, pp. 27–32, 1 pl.

GRAY, JOHN E. 1853. Revision of the families of nudibranch mollusks with the description of a new genus of Phyllidiadae. Annals and Magazine of Natural History, ser. 2, vol. 11, pp. 218–220.

GUANG-YU, LIN, and TCHANG SI. 1965*a*. Opisthobranchia from the inter-tidal zone of Hainan Island, China. Oceanologia et Limnologia Sinica, vol. 7, no. 1, pp. 1–20, pls. 1–3.

——— 1965*b*. Étude sur les mollusques Pleurobranchidae de la côte de Chine. Oceanologia et Limnologia Sinica, vol. 7, no. 3, pp. 265–276, pl. 1.

IREDALE, TOM, and MCMICHAEL, DONALD F. 1962. A reference list of the marine Mollusca of New South Wales. Memoirs of the Australian Museum, vol. 11, pp. 1–109.

KENNY, RON. 1960. Some opisthobranch molluscs from Queensland. University of Queensland Papers, Department of Zoology, vol. 1, pp. 223–228.

MACNAE, WILLIAM. 1958. The families Polyceridae and Goniodorididae (Mollusca, Nudibranchia) in Southern Africa. Transactions of the Royal Society of South Africa, vol. 35, no. 4, pp. 341–372, pls. 17–18.

——— 1962. Notaspidean opisthobranchiate Mollusca. Annals of the Natal Museum, vol. 15, no. 15, pp. 167–181, 7 figs.

MACNAE, WILLIAM, and MARGARET KALK. 1958. A natural history of Inhaca Island, Moçambique. Witwaters Rand University Press, Johannesburg. vi + 163 pp., 30 figs.

MARCUS, E. 1965. Some Opisthobranchia from Micronesia. Malacologia, vol. 3, no. 2, pp. 263–286, 41 figs.

MARCUS, ERNST, and EVELINE MARCUS. 1957. Sea-hares and side-gilled slugs from Brazil. Boletim do Instituto Oceanográfico, Sao Paulo, vol. 6 (1955), pp. 3–49, pls. 1–8.

——— 1960. Opisthobranchia aus dem Roten Meer und von den Malediven. Abhandl. Akademie der Wissenschaften und der Literatur in Mainz, 1959, no. 12, pp. 871–934, 86 figs.

——— 1962. Opisthobranchs from Florida and the Virgin Islands. Bulletin of Marine Science of the Gulf and Caribbean, vol. 12, no. 3, pp. 450–488, 28 figs.

——— 1967. American opisthobranch molluscs. Studies in Tropical Oceanography (Institute of Marine Science, University of Miami), vol. 6. vii + 256 pp., 1 pl., 246 figs.

——— Opisthobranchs from Curaçao and faunistically related regions. Studies on the Fauna of Curaçao and Other Caribbean Islands, vol. 33, no. 122, 157 figs. In press.

MARCUS, ERNST, and JOHN B. BURCH. 1965. Marine euthyneuran Gastropoda from Eniwetok Atoll, Western Pacific. Malacologia, vol. 3, no. 2, pp. 235–262, 43 figs.

ODHNER, NILS H. 1926. Die Opisthobranchien. Further Zoological Results of the Swedish Antarctic Expedition, 1901–03, vol. 2, pp. 1–100, pls. 1–3.

——— 1934. The Nudibranchiata. British Antarctic Terra Nova Expedition, 1910. British Museum (Natural History) Reports, vol. 7, no. 5, pp. 229–309, pls. 1–3.

O'DONOGHUE, CHARLES A. 1929*a*. Report on the Opisthobranchiata. Results of the Cambridge Expedition to the Suez Canal. Transactions of the Zoological Society of London, vol. 22, no. 6, pp. 713–841, figs. 214–231.

——— 1929*b*. Opisthobranch Mollusca collected by the South African marine biological survey. Report, Fisheries and Marine Biological Survey of South Africa, no. 7 (1928–1929), pp. 1–84, pls. 1–8.

OSTERGAARD, JENS M. 1955. Some opisthobranchiate Mollusca from Hawaii. Pacific Science, vol. 9, pp. 110–136, pls. 1–2, 17 figs.

PEASE, W. HARPER. 1861. Descriptions of new species of Mollusca from the Pacific Islands. Proceedings of the Zoological Society of London, 1861, pp. 242–247.

——— 1868. Descriptions of marine Gastropodae inhabiting Polynesia. American Journal of Conchology, vol. 4, no. 2, pp. 71–80, pls. 7–9.

PILSBRY, HENRY A. 1893–1895. Order Opisthobranchiata. Manual of Conchology, vol. 15, pp. 134–436, pls. 18–61.

——— 1895–1896. Opisthobranchiata. Manual of Conchology, vol. 16, pp. 1–262, pls. 1–74.

PRUVOT-FOL, ALICE. 1934. Les Opisthobranches de Quoy et Gaimard. Archives du Muséum National d'Histoire Naturelle, sér. 6, vol. 11, pp. 13–92, 1 pl., 30 figs.

——— 1951. Révision du genre *Glossodoris* Ehrenberg. Journal de Conchyliologie, vol. 91, pp. 76–164.

——— 1954. Etude d'une petite collection d'opisthobranches d'Océanie Française. Journal de Conchyliologie, vol. 94, pp. 3–30.

——— 1956. Révision de la famille des Phyllidiadae. Journal de Conchyliologie, vol. 96, pp. 55–80, figs. I–IX.

——— 1957. Révision de la famille des Phyllidiadae, Pt. 2. Journal de Conchyliologie, vol. 97, pp. 104–135, pl. 1, 52 figs.

——— 1960. Les organes génitaux des opisthobranches. Archives de Zoologie Expérimentale et Générale, vol. 99, pp. 135–223, pls. 1–4.

RISBEC, JEAN. 1928. Contribution à l'étude des nudibranches Néo-Calédoniens. Faune des Colonie Françaises, vol. 2, pp. 1–328, pls. A–D, 1–12.

——— 1930. Nouvelle contribution à l'étude des Nudibranches Néo-Calédoniens. Annales de l'Institut Océanographique, Paris, n. ser., vol. 7, pp. 263–298, pl. 1.

——— 1953. Mollusques nudibranches de la Nouvelle-Calédonie. Faune de l'Union Française, vol. 15, pp. 1–189, 126 figs.

——— 1956. Nudibranches du Viet-Nam. Archives du Muséum National d'Histoire Naturelle, Paris, sér. 7, vol. 4, pp. 5–34, pls. 1–22.

THIELE, JOHANNES. 1925. Gastropoda der Deutschen Tiefsee-Expedition. Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition . . . "Valdivia," vol. 17, pp. 1–348 (37–382), pls. 1–34.

——— 1931. Handbuch der systematischen Weichtierkunde. Vol. 1. Jena. vi + 778 pp., 783 figs.

——— 1935. Handbuch der systematischen Weichtierkunde. Vol. 2. Jena. v + 376 pp., 114 figs.

VAYSSIÈRE, ALBERT. 1898. Monographie de la famille des Pleurobranchidés. Annales des Sciences Naturelles (Zoologie), sér. 8, vol. 8, pp. 209–402, pls. 13–28.

——— 1912. Recherches zoologiques et anatomiques sur les opisthobranches de la Mer

Rouge et du Golfe d'Aden, II. Annales de la Faculté des Sciences de Marseille, vol. 20, pp. 5–158, pls. 1–11.

VERRILL, ADDISON E. 1900. The nudibranchs and naked tectibranchs of the Bermudas. Transactions of the Connecticut Academy of Arts and Sciences, vol. 10, pp. 545–550, pl. 66.

WHITE, KATHLEEN M. 1948. On a collection of marine molluscs from Ceylon. Proceedings of the Malacological Society of London, vol. 27, pp. 199–205.

——— 1950. On the nudibranch genera *Platydoris, Artachaea* and *Hoplodoris*. Proceedings of the Malacological Society of London, vol. 28, pp. 93–101, pl. 9.

YOUNG, DAVID K. 1967. New records of Nudibranchia . . . from the central and west-central Pacific. Veliger, vol. 10, pp. 159–173, 18 figs.

ZILCH, ADOLF. 1959–1960. Euthyneura. In: Otto H. Schindewolf, ed., Handbuch der Paläozoologie. Vol. 6, pt. 2, xii + 834 pp., 2515 figs.